Vitria Technology, Inc.

Model-Driven Tools Bring Together Supply Chain Partners

In a typical factory in the mid-1990s, diverse tasks required specialized software that was costly to operate and maintain. There was no process to track an order's life cycle through several software systems and no support tools to quickly reconfigure a system if needed. Integrated hardware and software solutions called manufacturing execution system (MES) were too expensive for most companies. Vitria Technology, a start-up company in California, wanted to build a generic, highly configurable MES engine for the model-driven factory environment. This all-purpose engine would perform common MES functions within a set of factory operations captured as a model. If the nature of the operations on the factory floor changed, the model would change and the MES engine would easily reconfigure itself to respond to the new model. This model-driven engine would reduce programming costs for U.S. manufacturers and would answer their long-felt need to deliver high quality at a low cost.

Developing specialized MES components was difficult. Vitria's concept of a generic MES engine was far from the existing trend toward specific tools for custom applications. So the concept was considered high risk and deterred most investors. Vitria's concept would also require the development of innovative types of software tools. Lacking sufficient resources of its own, Vitria applied for Advanced Technology Program (ATP) funding in 1995 and launched a two-year research project in January 1996. The project ended in 1998 with the successful creation and validation of Vitria's model-driven generic engine prototype. They received three patents for this work.

While working on this project, Vitria researchers realized that existing systems integration approaches could not link business and manufacturing processes between organizations. They planned a new class of software tools, the Process Integration Engine (PIE), that could manage complex business processes across companies. Along with the MES integration technology developed in the earlier research, PIE could bring organizational efficiency and operational improvement to small and medium-sized businesses and provide them with a competitive advantage in the global market. Lacking resources to sponsor this new research idea, Vitria turned to ATP again and received cost-shared funding in 1997. Both research projects were awarded under the 1995 and 1997 focused programs, "Technologies for the Integration of Manufacturing Applications (TIMA)." The PIE research project ended in 1999, the same year that Vitria went public, with prototype software tools to integrate networked resources for visibility and measurability across companies. Vitria received four patents for their innovative work in the PIE project.

MES and PIE, incorporated into the BusinessWare packaged solution, have provided U.S. manufacturers with flexibility and compatibility at an affordable price and have pioneered a new field called business process management (BPM). As the BPM leader, Vitria was included in the 2005 and 2006 Supply & Demand Chain Executive 100. The company posted gross profits of $11.1 million for the third quarter of 2006 and projected an upbeat future. In September 2006, the company was taken private by a new corporation formed by its original founders at a price of approximately $67 million. In June 2007, Vitria launched two additional products based on the same core technology.

COMPOSITE PERFORMANCE SCORE

(based on a four star rating)

* * * *

Research and data for Status Reports 95-12-0015 and 97-05-0011 were collected during October–December 2006 and updated in July 2007.

No Factory Is an Island

In the 1990s, U.S. manufacturing companies realized that the way to achieve competitive advantage was to reduce labor, machinery, space, development time, and a product's life cycle, as well as achieving zero defects. No factory was an island in itself, and customer needs, delivery times, efficient procurement, just-in-time supply, and total quality management, which were outside the purview of production systems in factories at that time, were all part of the new dynamic. "As companies tear down the walls between the different parts of their work, they are realizing that the various parts need to share the same flow of information," wrote The Economist in its manufacturing survey[1]. Faced with increasing globalization of suppliers, customers, and production facilities, manufacturers needed an information technology tool to track and coordinate multiple systems. There were diverse kinds of software and hardware used on the factory floor, but there was no overarching system that enabled information to flow across the order, supply, and manufacturing systems.

Typically, when a product order was placed with a company, one of the company's software systems searched the inventory to determine if the order could be fulfilled. If there was not enough inventory to fulfill the order, another order management system allocated its fulfillment to a factory's production schedule; a third system allocated resources such as raw material, parts, and components to that factory to successfully meet the production deadline; and a delivery management system ensured that the order was successfully delivered to the customer. Through the mid-1990s, these business process systems were not visible to each other, and tracking each process was a complex task.

MES Was Beyond the Reach of Many Manufacturers

A manufacturing execution system (MES) was an integrated hardware and software solution that measured and controlled manufacturing activities in factories to increase productivity and improve quality. Because MES vendors used various modeling tools, languages, and interfaces, manufacturers procuring these systems had to invest further in training operators, help-desk personnel, and system administrators. These MES applications were also difficult to integrate with existing tracking engines and to configure with other software. Thus, a typical MES was too expensive for most small and medium-sized manufacturers. On the other hand, a single general-purpose MES engine with plug-and-play capabilities would cost much less to acquire, operate, maintain, and configure. It would also be possible to build one tracking engine for the entire product line and order life cycle in a flexible MES environment.

Vitria Has Adaptable Factory Vision

Vitria, a start-up company in California, drew up research plans for such a generic, highly configurable MES engine. Operators would be able to operate and configure MES components from their general-purpose engine and would not have to use individual, proprietary software programs. Vitria called this an "adaptable factory environment," because the generic engine, with capabilities for plug-and-play and the dynamic integration of software components, would adapt itself to a particular set of factory conditions, rules, and policies captured as a model. The generic engine would implement common MES functions, such as tracking and life cycle management, within this model. Whenever the policies, practices, or processes of the factory changed, the model would be readjusted and the engine reconfigured easily to operate in the new model.

During the 1990s there was no overarching system that enabled information to flow across the order, supply, and manufacturing systems.

Two broad categories of model-driven engines were planned: application engines, such as tracking engines, and integration engines, such as translators between software systems. Fewer software applications would be required to perform tasks in a manufacturing environment if some of the tasks were similar in nature and could be performed by a single general-purpose

[1]Published June 20, 1998.

NOTE: *This status report describes two ATP projects. Although the technology developed during each project was very different, both technologies were used and commercialized in a single product line. This became the core business of Vitria Technology. Therefore, information about both projects is presented here as two research outcomes culminating in one successful product.*

engine. For example, under Vitria's plan, tracking resources and equipment or managing equipment and process specifications could be done by the same generic component in the MES. This would reduce costs and increase visibility at all stages of the operation cycle.

Plan for Model-Driven Engine Faces Major Challenges

Developing specialized MES components was difficult in 1995; to build an all-purpose generic engine for model-driven components was even more difficult. If the adaptable factory concept was to materialize, Vitria would have to develop new MES methods to support dynamic adaptability, new programming languages to support configurability, and new component interaction rules to support dynamic integration. Performance requirements on the factory floor were rigorous, and the new system would have to be both modular and scalable. Not only did this require a high degree of technical innovation, it also posed significant technical risks.

Vitria identified factory automation groups in small to mid-size manufacturers as the initial target market for application engines. They meant to focus on industries like transportation, telecommunications, healthcare, petrochemical, and construction. Because only a few model-driven engines could track various processes, businesses would need fewer software systems, would be able to re-use software components, and would decrease software life cycle costs by adapting these components to new factory models. Specifically, if the research was successful, Vitria estimated that companies could realize a 50-percent savings in MES procurement, integration, and maintenance costs. However, an important question was whether generic application engines could replace specialized but less configurable MES applications.

While current MES architecture used many applications from different vendors and required significant expenditures in time and money to integrate them, Vitria proposed a departure from this model. They wanted to build an integrated architecture for a general-purpose engine for the major categories of an MES. Venture capitalists and other investors considered this concept too risky to support, and the company lacked resources to fund the research. So Vitria successfully applied to ATP in 1995 for participation in cost-shared research and launched a two-year, ATP-funded research project in January 1996. According to one company representative, ATP support was crucial because Vitria's approach was so novel, the MES market so fragmented, and the target problem so difficult to solve.

Taxonomy of Engines Could Address Manufacturing Needs

The Vitria research team planned to define a taxonomy of MES engines, develop prototypes of key model-driven engines, build a test-bed for real-time decision-making capabilities, and establish an end-user group to ensure its applicability. Researchers would have to determine a method to interpret factory functions in application engines as well as how to implement them. Vitria was not seeking to develop a universal engine capable of handling all major functions in a factory; rather, they planned to group applications into categories of related functionality and then design and prototype engines to support each category. The result would be a taxonomy of engines, built of common subcomponents, but specialized to address one or more functional needs within the factory model.

The project work plan was divided into four phases:

1. Create a description language for responding to MES models in a factory
2. Design application engines and build the MES engine taxonomy
3. Develop and integrate adaptable components for a model-driven MES
4. Develop a set of application engine prototypes and integrate the engine into the larger system for a test-bed demonstration

Researchers Design Life Cycle Engine

Factory models and programming languages played a pivotal role in Vitria's MES engine concept. MES applications would monitor situations and trigger response actions to specific situations as necessary. Application engines implemented basic functions under MES; but factory models conveyed rules for these engines to follow while responding to situations or events. Vitria used standardized programming languages for laying down these rules. For example, if an "equipment failure" event occurred, several affected

components would have to be immediately notified. Vitria researchers envisioned technology that would define rules for automatic notification and response to this event. They also designed a life cycle engine to manage equipment, support demand-based interactions in near real time, and support event rules over the life cycle of an order. In 1995, they set up a user group with Intel and Motorola to gather input from the field. Users shared automation and integration problems, reviewed research results, and reviewed application issues from the Vitria research.

The Vitria team built a preliminary prototype of an object engine that could process rules when triggered by an event, but had the added capability to extend or override a rule. The engine included a support tool for making decisions in real time. Typically, raw data were generated directly by processing and testing equipment, and status data were generated by a variety of tracking systems. These two types of data were processed by a tracking engine for real-time decision making. Users would put a query, and the application would then evaluate the data and respond to the query. Finding both the right language for this query and the mathematical models for responding were significant challenges in developing a real-time decision-support tool. Furthermore, these tools had to process multiple queries; for each query, there were many rules calling for appropriate transactions. A feature of the Vitria prototype support tool was its ability to tackle multiple real-time queries.

Vitria Builds Integration Engine Prototype

In the eighth and final quarter of the research project, the Vitria team demonstrated a test bed to validate the new model-driven engine. The test-bed scenario consisted of communicating a particular order allocation from a company's enterprise resource planning (ERP) system to its factory's MES and then subsequently tracking the allocations through the work in process (WIP) systems. The test bed demonstrated the following:

- Feasibility of using model-driven engines to solve realistic MES problems
- Capability to automate the complex behavior of MES components through interacting models
- Scalability of the architecture across multiple applications and the enterprise

The test bed scenario attempted end-to-end visibility throughout the life cycle of an order (from placing the order to fulfillment and eventually delivery). Typically, the order management system accepted orders, coordinated order allocation to a factory, sent allocations to the appropriate factory for fulfillment, and tracked the status of allocations thereafter. A separate inventory system aggregated current inventory and production plans from various factories. Based on this consolidated inventory information, the order management system allocated orders to factories. At each factory, two systems were involved: the WIP system and an inventory management system for finished goods. Upon receipt of an order allocation by the factory, the WIP system allocated product supply either out of inventory or out of future production. On the date of shipping, the inventory management system would collect items from the inventory to satisfy order allocation and then ship the order. This resulted in a shipment notice being sent back to the corporate order management system.

The Vitria team built a preliminary prototype of an object engine that could process rules when triggered by an event.

Vitria produced two models to represent the order processing and inventory management: the factory life cycle and the product life cycle. They also included a real-time decision-support engine to this test bed to query both order information and order process information. The test bed successfully combined multiple model-driven engines and for days ran multiple interacting models in a factory environment. This enabled Vitria to claim viability of model-driven engines in the MES. They received three patents for this work.

Vitria Pioneers Business Process Management

Vitria initiated commercialization efforts almost as soon as the ATP-funded research project ended. The first product developed from this technology, Agiliti, was based on the life cycle tracking engine. Later, Agiliti was incorporated into BusinessWare, a packaged solution for MES integration. Utilizing features of BusinessWare, systems analysts rather than software programmers could define generic, broad-based models for MES components in a business environment, track the

product or factory life cycle, and respond with a real-time decision-making tool to effect changes. In 1999, Vitria pioneered the field of business process management (BPM) with the invention of this model-driven integration engine. BPM referred to communication management activities performed by companies to optimize and adapt their business processes. Although the goals of BPM had made sense to companies for a long time, a software tool like Agiliti made them a reality. BPM was widely accepted because it could monitor a business process, analyze performance, and make changes to the original processes in real-time.

Referring to these innovations, one analyst wrote in *Automation World*[2]: "The benefits of a completely integrated enterprise are wide ranging. Real inventory visibility allows for less investment in materials. Better scheduling means improved use of assets. But the biggest benefits come from greater responsiveness to customer demand. Greater visibility delivers production agility. Also critical is the ability to see and manage product on the floors of multiple plants, breaking down the traditional blind-silo effect that comes from multiple sites that each run on a different automation system. Integration lets managers view real-time data at all plants." Manufacturers needed to connect the plant floor to the ERP applications, the supply chain systems, and the customer networks in a smooth flow of communication to enhance capabilities and increase profits.

Vitria pioneered the field of business process management.

A supply chain is the set of business processes and resources across multiple companies that transforms a product from raw material into finished goods and delivers those goods into the hands of the customer. Historically, companies differentiated themselves from their competition by factors such as product features, price, and quality. In 1997, the differentiator became the speed of product launch and shorter product life cycle. With this, engineering change orders occurred more frequently, and inventories had to be adjusted quickly to leverage market advantage and avoid product obsolescence. Companies realized that the effective re-engineering of business processes must include cooperating with vendors and customers on supply chain issues. Vitria researchers concluded that a supply chain's success depended on partnering effectively with suppliers and customers and sharing information with them to easily respond to market changes. Toward this end, Vitria conceived of technology that would integrate processes and business systems within and across companies.

Vitria Targets Inter-Company Process Integration

In the late 1990s, systems integration approaches did not attempt to link business and manufacturing processes or to link the MES and the ERP system. However, there was a definite need to link "vertically between factory and corporate systems, laterally across factories, and outwardly to suppliers," according to Vitria CEO, J. Chang, in 1997. After successfully integrating the intra-company business processes, it was time to look at inter-company integration issues. Vitria believed that a new class of software tools, the Process Integration Engine (PIE), could manage complex business processes like supply chains, manufacturing systems, bill processing, and customer support in a plug-and-play environment. The PIE technology would be a series of model-driven tools to configure operational links between the manufacturing and business systems at each partnering organization. Companies would not have to cope with proprietary systems and software incompatibilities when linking business processes between suppliers, manufacturers, and customers if the plug-and-play architecture of PIE was successful.

Vitria anticipated that PIE would appeal to large markets with complex supply chains such as manufacturing, financial services, healthcare, and telecommunications. Anticipated benefits included faster and cheaper integration of processes and organizations, wider use of supply chain management methods, and lower process and software re-engineering costs. Maintenance accounted for up to 70-percent of the cost of owning and integrating software applications. The potential savings in the manufacturing sector, according to Vitria, could be as high as $7 billion per year after 5 years, based on a 15-percent market penetration.

[2]"Closing the Gap." *Automation World,* p. 47, September 2005.

PIE and the model-driven MES engines developed earlier would facilitate manufacturing and supply chain integration to improve productivity and product quality. At the same time, PIE would provide a computing environment that would be easier to implement and modify, thus enhancing the benefits of model-driven engines. Vitria expected that such off-the-shelf process integration engines could eliminate the need for custom programming that was required to integrate ERP solutions with other supply chain software components.

Differences in Business Processes Posed Challenges

The PIE research faced four key technical challenges:

1. **Variations in common processes among businesses.** Within the order fulfillment process, for example, there were two subprocesses: an ordering subprocess initiated and executed by a customer and a demand fulfillment subprocess executed by the supplier. Corporations did not have the resources to re-engineer these into a common process for integration.
2. **Autonomy across shared systems.** Different business systems did not have formal agreements about shared resources and activities. For example, corporate ERP systems controlled factory-level resources even if the latter were under an MES.
3. **Resolution of conflicting policies among business partners.** Policies of different organizations conflicted when used together. For example, a company's resource allocation policy could conflict with a partner company's factory-level just in time (JIT) allocation policy and create instability or lack of optimization in resource allocation.
4. **Communication with multiple data formats and protocols.** Various ERP systems and MESs used different communication protocols and formats for messages and business entities.

The differing traits of the various systems listed above meant that Vitria would have to develop extensive rules for conflict resolution in its integration engine. For example, a customer had a policy of payment after receipt of goods, while a supplier had a policy of payment before shipment of goods. The Vitria model would look for a reconciliation of these two apparently conflicting policies by making the payment, shipment, and receipt simultaneous or by introducing the option of credit card payment. Thus, the model established an event rule on the basis of pre-determined rules agreed on and implemented manually to reconcile the conflict automatically. The technology challenge underlying this concept was significant. It involved resolving legacy integration, real-time online process/system modification, and other complex issues with supply chain integration.

Process Integration Is Key to Competitive Advantage

Vitria lacked the resources to fund this kind of innovative research; high technical risks drove away traditional sources of funding as well. In 1997, venture capitalists typically required fast-track product development, thus undermining the extensive testing phase that this technology would require. Large ERP and MES software suppliers saw Vitria's research as potential future competition and refused to fund the research. Vitria had also unsuccessfully sought partnerships with large system integration companies. Therefore, the company turned to ATP for cost-shared funding and launched the research in October 1997. This novel technology for process integration was expected to bring organizational efficiency and operational improvement within reach of small and medium-sized businesses and provide them with a competitive advantage in the global market.

Vitria conceived of technology that would integrate processes and business systems within and across companies.

Along with their successful MES model-driven engines in the earlier project, Vitria was now ramping up for a comprehensive process integration suite on a scale not previously envisioned by other companies. For Vitria, the ATP funding gave a three- to five-year leap in technology development time and a huge market

advantage. For supply chain applications, this research would provide process integration through generic templates and sub-models in place of large-scale custom programming, thus making it fast, less costly, and more productive. Concurrently, software re-engineering costs would be greatly reduced by enabling the simulation of corporate business processes of different companies across applications, and customer service and factory productivity would be radically improved.

Researchers Design and Validate PIE Prototype

In the first phase of this research, Vitria worked on identifying the issues behind process integration. They established rules for compatibility and conformance of different processes and systems, while stressing that any integration scenario must reflect process variations that were common in the real world. Vitria also worked with a corporate consortium called Extended Enterprise Coalition for Integrated Collaborative Manufacturing Systems (EECOMS) to validate this research in a real-world scenario. During the third quarter of the project, Vitria researchers started designing a PIE prototype and realized that their earlier work on model-driven life cycle tracking engines provided a conceptual foundation for their current work.

To demonstrate the viability of composite process integration, they built a “connection model” to link external IT systems to the PIE prototype. Such an external system could be an ERP application, a database, a front-office system, or a filing system. The connection model had to start and stop by itself, learn about its environment, exchange data with an external system, and send or receive messages on events. Vitria demonstrated the validity of PIE in a quote-to-order scenario provided by i2 Technologies, the leading vendor of supply chain planning at that time. In this demonstration of the PIE, eight independent process models worked together as a single component across connection models, integrating three separate legacy software systems.

In 1999, the Vitria team incorporated template functionality into the PIE prototype. They planned an overarching supply chain integration solution for the RosettaNet consortium of computer manufacturers, distributors, resellers, and retailers. This was a proof of concept for Internet-enabled process models to streamline and automate business-to-business interactions between trading partners. After the ATP-funded project ended, there was a great deal of enthusiasm to commercialize this technology into supply chain domain templates for RosettaNet-type interactions. In May 2000, 3Com Corporation successfully implemented BusinessWare for RosettaNet. This application enabled 3Com to streamline key supply chain processes, such as catalog management and order fulfillment, by automating the exchange of information and transactions between internal IT systems and the IT systems of their customers, suppliers, and partners. 3Com successfully demonstrated the electronic distribution of new product information to trading partners such as CompUSA based on RosettaNet's e-business specification.

Finally, PIE provided software tools to integrate networked resources for end-to-end control, visibility, and measurability across business processes. These applications displayed a high level of complex logic in business policies, data handling, and management, which until then had required scheduling and approval by the IT staff. PIE solved these problems by providing U.S. manufacturers with flexibility and compatibility at an affordable price. Vitria received four patents for their innovative work in the PIE project.

Vitria Launches BusinessWare Using Both Technologies

Vitria went public on September 17, 1999 with its initial public offering of 3 million shares on the NASDAQ at $16 per share. The PIE research ended around the same time. This was also the time when most companies were moving towards an Internet-enabled, e-business model to manage resources and supply chains efficiently and respond to changes quickly. Vitria’s new technology was uniquely positioned to help these companies integrate processes and cut costs, and with $10 million in venture capital, they were ready to commercialize their innovations.

The first generation of BusinessWare was based on the model-driven computing technology from the first ATP-funded project and enabled companies to integrate business processes within an enterprise. Incorporating the PIE technology from the second ATP-funded project, the second-generation BusinessWare enabled companies to integrate business-to-business processes

across suppliers, customers, and service providers. Vitria's pioneering work in BPM started with the launch of Agiliti after the first ATP-funded project and improved considerably with the launch of BusinessWare 2.0. Companies quickly realized that eliminating delays and errors in operational processes improved customer satisfaction and increased revenue, which led to the success of BusinessWare. In April 2000, BusinessWare 3.0 was launched. It allowed companies to quickly create and deploy business-to-business solutions by providing an end-to-end software product that seamlessly combined BPM and other enterprise-wide applications.

Vitria promoted BusinessWare as an enterprise-wide, mission-critical solution for process integration. "Through the innovation of our model-driven, e-business platform, Vitria makes it easy for application providers and industry specialists to capture and manage their domain expertise as software models," a company representative claimed. The company also wanted to make use of the "viral effect" that the company representative described as follows: "Our customers often lie at the center of a large community of partners…The partners see first-hand the benefits of our software and want it themselves. They quickly become Vitria customers and in turn, introduce Vitria to their customers and partners." Initially, Vitria focused on telecommunications and supply chain manufacturing companies as prospective clients. But over the years, they have widened their customer network and have built strategic partnerships with numerous companies.

Strategic Partnerships Enhance Commercialization Plans

In early 2000, Vitria entered into strategic partnerships with several companies such as Emerald Solutions, exiom Technologies, and NightFire Software to leverage their technologies and/or business resources to strengthen BusinessWare. Similarly, with an eye towards the huge financial services sector, Vitria built a partnership with Volanté Technologies, a leading provider of data-centric solutions to the financial services industry. In the same year, BP, one of the largest oil companies, adopted BusinessWare to integrate its ERP systems into a global e-business platform. As a result, Vitria's total revenue for the third quarter of 2000 rose by 431-percent over the same period in 1999. In 2001, Goodyear Tire Company used BusinessWare for enterprise application integration and BPM in 17 projects. As part of the arrangement, Goodyear, the world's largest tire maker, also introduced Vitria to its partner base. BusinessWare answered a long-felt need among U.S. manufacturers and service providers.

Many Satisfied Customers Validate Vitria Package

In 2002, British Telecom wanted to expedite the order fulfillment process for their broadband customers. The entire order fulfillment process normally took five days to complete, from taking the customer's order, checking availability, dispatching equipment, notifying British Telecom's Wholesale Division to provision the network, and, eventually billing the customer. By integrating key applications and supporting the life cycle of the order management process, BusinessWare shortened the time lag from five days to eight minutes or less. With customer satisfaction at 80-percent and higher, more broadband customers enrolled online, and BusinessWare could handle the increased number of order entries from British Telecom's website.

Deutsche Bank, Europe's second-largest bank, used BusinessWare to develop a proprietary application management platform called Deutsche Bank Information Bus (dBus). The dBus platform facilitated securities trading worldwide. When traders placed buy or sell orders through dBus from any location, the trading information was disseminated throughout the company's back-office systems. dBus users accessed the system, located in one central data center and maintained by just one support group, to gain an integrated view of securities trading activity worldwide.

Similar performance improvement was achieved by Jefferson-Pilot Corporation, a large shareholder-owned life insurance company in the United States. They wanted a web-integrated system for e-business so that customers, business partners, and suppliers would be able to conduct business in real time or near real time over the Internet. Leveraging BusinessWare's process management capabilities, the company automated communication flow, from claims processing to customer information, and significantly reduced the time to respond to customer orders and inquiries.

Reynolds and Reynolds improved the car-buying process for retail buyers in the United States by

integrating many aspects of automotive retail processes. Using BusinessWare for its application integration and process automation capabilities, the company improved order turn-around time and increased the volume of transactions that its back-end systems could process at any given time. The BPM functionality of BusinessWare helped to integrate the company's legacy systems with multiple back-end systems. By re-engineering the business processes with BusinessWare, Reynolds successfully streamlined and automated internal processes and Web-enabled many of its operational support systems, improving service to its customers in the competitive automotive retail marketplace.

Several automobile manufacturers have implemented BusinessWare to greatly improve process integration. For instance, in 2003, Nissan Motor Company used BusinessWare to integrate business processes across its global enterprise. The Renault/Nissan Information Systems (RNIS) had to migrate from localized solutions to an environment of strategic implementations across the global enterprise using cross-platform resources. The BPM capabilities and legacy connectivity options of BusinessWare attracted Nissan. They implemented BusinessWare in a supplier portal project at Nissan's Tennessee manufacturing facility as a pilot and later adopted this kind of integration as their global standard.

XM Satellite Radio sought to automate processes related to radio subscription fulfillment and customer billing. Once an XM sales representative put in an order for radio service, the business process model component of the supply chain software routed the order information to the appropriate authorities including the satellite service provider, thus activating the radio service and sending new customer account information to the company's billing system. BusinessWare seamlessly integrated the ordering, installing, and billing systems and gave XM the same degree of customer satisfaction and quick-to-market successes that British Telecom had experienced earlier.

Collaboration with MasterBrand Results in One Touch Order Management

In 2004, as MasterBrand Cabinets rapidly grew through acquisitions to become the largest supplier of kitchen and bath cabinets, they needed to integrate supply chain management systems from six different companies without replacing any of its legacy systems. They used BusinessWare's end-to-end visibility and integration infrastructure to integrate disparate systems in order management, fulfillment, ERP, and supply chain processes. Vitria and MasterBrand collaboratively built the One Touch Order Management solution for order life cycle management across multiple platforms and business applications. The benefits were significant: a 40-percent drop in customer service call volume, a 20-percent drop in manual data entry, savings of more than $300,000 per year in shipping costs by tracking back orders, and an 80-percent reduction in administrative costs to maintain multiple websites[3]. MasterBrand won Network World's 2006 Enterprise All-Star Award for this innovative supply chain process management and integration. "Not only does this award further validate the power of Vitria's business process applications, it illustrates that our customers are forward-looking companies making investments in technologies that can transform, automate and streamline their business processes to drive competitive advantage, forge market leadership and create exceptional levels of customer satisfaction," commented a Vitria official.

In 2005, Southern Company, one of the largest producers of electricity in the United States, implemented BusinessWare in the first phase of its multi-year enterprise application integration (EAI) strategy. Vitria connected Southern Company's supply chain Accounting Materials & Procurement System to an external energy trading network.

Healthcare Becomes Main Target Area

Vitria promoted BusinessWare to the healthcare industry as a tool to integrate transactions, eligibility and benefit verification, referrals, authorizations, claim submissions, and claim status inquiries. Availity, an independent company that worked as an information gateway between Florida healthcare providers, health plans, and other healthcare stakeholders, incorporated BusinessWare in its transaction management operations. "Vitria has substantially assisted in helping us improve the speed and accuracy of claims processing, enabling us to give our clients greater control over and access to patient claims and insurance information and allowing them to focus their efforts on

[3]Data from www.vitria.com.

what they do best, which is provide medical care services," explained the chief executive officer of Availity[4]. By using BusinessWare, and "enabling real-time information exchange at no cost to physicians and other healthcare professionals, Availity estimates it has reduced the average transaction cost to providers to just 25 cents and has reduced the average payer cost to an estimated $2 per transaction. That's down from roughly $8 per transaction for providers and $15 per transaction for payers. Moreover, the average time to reimbursement for electronic claims is dramatically lower," she added.

Through business process applications, Vitria created a healthcare information exchange (HIE) to streamline the information flow between organizations across the healthcare value chain. HIE allowed healthcare-related service providers to receive, open, validate, and process electronic packages of information from registered trading partners and then repackage and route them appropriately. This automated claims and exception management brought full operational visibility and centralized processing of secure transactions across healthcare-related services. In 2005, Vitria launched Smart Gateway, based on the same integration technology from their two ATP-funded research projects, to add "a framework for emerging clinical interoperability" or integrated electronic health records. Typically, the total cost per claim dropped by 17-percent with the implementation of Vitria's healthcare applications.

Vitria Is Recognized as Market Leader

In 2006, Vitria was named in the Supply & Demand Chain Executive 100 market leaders for the second year in a row. Vitria was also named in 2006 to the START-IT 125 list of the most influential manufacturing technology providers published by *START-IT Magazine*. Gathering business momentum from its technical innovations, Vitria posted a gross profit of $11.1 million for the third quarter of 2006 and an upbeat prospect ahead. The total revenue for this period was $14.6 million compared with $11.2 million for the second quarter of 2006 and $13.5 million for the third quarter of 2005. As of September 2006, Vitria had been taken private by a new corporation formed by its original founders at a price of approximately $67 million. In June2007, Vitria launched two major products: Business Accelerator which is a service-oriented architecture suite for enterprise-wide solutions, and the next generation Resolution Accelerator which was the first software to automate exception management and resolution across supply chains and business processes. Both products are major advances in BPM; at the same time both leverage the company's extensive research and innovation starting with the two ATP-funded projects.

Conclusion

In 1995, diverse tasks in a typical factory required specialized software that had to be operated and maintained at a high price. There was no process to track an order's life cycle through several software systems and no support tools to quickly re-configure a system if needed. Vitria Technology wanted to resolve this by building an all-purpose engine that would perform common manufacturing execution system (MES) functions, such as tracking and life cycle management, within a set of factory operations captured as a model. Not only would this reduce programming costs, it would answer U.S. businesses' long-term need to enforce higher quality deliverables at a lower cost. Vitria succeeded in their ATP-funded research project and developed a model-driven, generic engine to integrate business processes within a company.

While working on this project, Vitria researchers realized that there was an opportunity to look beyond intra-company and towards inter-company integration issues. So they drew up a research plan for a new class of software tools, the Process Integration Engine (PIE), to manage complex business processes like supply chains, manufacturing systems, bill processing, and customer support in a plug-and-play environment. ATP funded this research and, in 1999, the second project successfully ended with a PIE prototype. Both these technologies were commercialized in a packaged solution for business process management called BusinessWare. It smoothed the flow of information across enterprise-wide and business-to-business applications. Healthcare, financial services, manufacturing, and supply chain industries have leveraged this technology to reduce the cost of operations and improve customer satisfaction.

[4]Data from www.vitria.com.

PROJECT HIGHLIGHTS
Vitria Technology, Inc.

Project Title: Model-Driven Tools Bring Together Supply Chain Partners

Project 1: To develop a generic manufacturing execution system (MES) engine for control across business processes on the factory floor.

Duration: 01/26/1996–12/25/1998
ATP Number: 95-12-0015

Funding (in thousands):

ATP Final Cost	$2,000	83.6%
Participant Final Cost	392	16.4%
Total	$2,392	

Project 2: To develop technology for integrating business processes across companies in supply chain, customers, and disparate corporate systems.

Duration: 10/01/1997–09/30/1999
ATP Number: 97-05-0011

Funding (in thousands):

ATP Final Cost	$2,000	88.9%
Participant Final Cost	250	11.1%
Total	$2,250	

Accomplishments: Vitria Technology successfully developed two technologies and pioneered a new field in information technology called business process management (BPM) as it completed two ATP-funded research projects. Its major accomplishments in the ATP-funded projects were:

Project 1

- Developed software to configure and use MES components from a generic engine
- Developed technology to automate the complex behavior of MES components through interacting models
- Achieved scalability of the new MES architecture across multiple applications and enterprises

Project 2

- Developed software to configure and use MES components from a generic engine
- Developed a new class of software tools called the Process Integration Engine (PIE)
- Developed technology that could manage complex business processes in a plug-and-play environment
- Provided fast, less costly, and more productive process integration through generic templates and sub-models in place of large-scale custom programming
- Developed a series of model-driven tools to overcome software incompatibilities when linking business processes between suppliers, manufacturers, and customers
- Reduced software re-engineering costs for companies by enabling the simulation of corporate business processes of different companies across applications
- Automated business-to-business interactions between trading partners

Vitria won the following awards and recognition for its innovative technologies and products:

- Supply & Demand Chain Executive 100 List, 2005 and 2006
- START-IT 125 List of Most Influential Manufacturing Technology Providers, *START-IT Magazine*, 2006
- Silver medal winner, 1st Annual EAI Forum, Switzerland, 2004
- Ranked 203 in Annual Software 500 list, *Software Magazine*, 2004
- BPM (Business Process Management) Top 5 Award, *BPM Today*, 2004
- Finalist,10th Annual Well-Connected Awards (Integration Suite category), *Network Computing,* 2004
- Ranked 266 in Deloitte Technology Fast 500 for North America, Deloitte & Touche, 2003
- Ranked 46 in Deloitte & Touche Technology Fast 50 Program for Silicon Valley, Deloitte & Touche, 2003
- Crossroads 2000 A-List Award, Open Systems Advisors (OSA), Best Process Automation Product for e-Business, 2000

Vitria received seven patents for their two ATP-funded technologies.

The following three patents are from Project 1:

- “Event-driven communication system”
  (No. 6,704,785: filed March 17, 1997, granted March 9, 2004)
- “Real-time query optimization in a decision support system”
  (No. 6,338,055; filed December 7, 1998, granted January 8, 2002)
- "Pre-computing reference collections in a decision support system”
  (No. 6,408,291; filed December 7, 1998, granted June 18, 2002)

PROJECT HIGHLIGHTS
Vitria Technology, Inc.

The following four patents are from Project 2:

- "Real-time decision support system" (No. 6,931,392; filed December 7, 1998, granted August 16, 2005)
- "Method of executing a data transformation specification" (No. 6,742,054; filed April 7, 2000, granted May 25, 2004)
- "Real time business process analysis method and apparatus" (No. 6,763,353; filed October 31, 2001, granted July 13, 2004)
- "Event driven communication system" (No. 6,901,447; filed August 15, 2002, granted May 31, 2005)

Commercialization Status: Vitria has incorporated the two technologies developed in the ATP-funded projects into one product called BusinessWare and has marketed it as an enterprise-wide, mission critical solution for process integration. The company has also entered into strategic partnerships with Emerald Solutions, exiom Technologies, NightFire Software, and Volanté Technologies to leverage the business and technical potential of BusinessWare. Vitria developed custom applications of BusinessWare such as the Deutsche Bank Information Bus System, One Touch Order Management solution for MasterBrand, and Smart Gateway for healthcare.

In June 2007, Vitria launched two major products: Business Accelerator which is a service-oriented architecture (SOA) suite for enterprise-wide solutions, and the next generation Resolution Accelerator which was the first software to automate exception management and resolution across supply chains and business processes. Both products are major advances in BPM; at the same time both leverage the company's extensive research and innovation starting with the two ATP-funded projects.

Outlook: The outlook for the MES and PIE technologies is strong. Gathering business momentum from its technical innovations, Vitria posted gross profit of $11.1 million for the third quarter of 2006 and an upbeat prospect ahead. In September 2006, the company was taken private by a new corporation formed by its original founders at a cost of approximately $67 million.

Composite Performance Score: * * * * (for both projects combined)

Focused Program: Technologies for the Integration of Manufacturing Applications (TIMA), 1995 & 1997

Numbers of Employees: 10 at first project start, 28 at second project start, 235 as of December 2006

Company:

Vitria Technology, Inc.
945 Stewart Drive
Sunnyvale, CA 94085

Contact: M. Dale Skeen

Phone: (408) 212-2700

Presentations:

- Ounjian, J., and Antonio P. Linares. "Clinical and Administrative Interoperability." Institute 2006, San Diego, CA, 2006.
- Ehrhardt, L. "The Imperative for a Customer-Centric BSS Infrastructure to Drive Top-Line Growth." Webcast in collaboration with Yankee Group, 2005.
- Product Showcase: "Telecommunications Integrated Order Management Solution." TeleManagement World, Nice, France, 2005.
- Product Demonstration: OrderAcclerator, Billing & OSS World, Philadelphia, PA, 2005.
- "Service-Oriented Approach to Business Process Applications: Seven Recommendations." Service-Oriented Architecture (SOA) Forum, Tokyo, Japan, 2005.
- Product Demonstration: BusinessWare 4.3. Gartner Application Integration and Web Services Summit, Los Angeles, CA, 2005.
- Product Demonstration: BusinessWare 4.3. German EAI-Forum 2005, Karlsruhe, Germany, 2005.
- Stawinski, M., and Thor Johnson. "eTOM Makes Real Business Sense for Cable Operators." TeleManagement World, Long Beach, CA, 2004.
- Product Demonstration: "Accenture STP Integration Platform, Powered By Vitria, An Advanced Solution for Real-Time Exception Management and End-To-End Trade Processing, and SWIFTcomplete." Sibos 2004, Atlanta, GA, 2004.
- Product Demonstration: "Innovative Solutions for Financial Organizations." Securities Industry Association (SIA) Operations Conference and Exhibit 2004, Palm Desert, CA, 2004.
- Product Demonstration: "Solutions for Business Process Integration for Industries." CeBit 2004, Hanover, Germany, 2004.
- Skeen, D. "Business Process Integration with Applications in a Service-Oriented Architecture." Blue Cross and Blue Shield Association e-Business Summit, San Francisco, CA, 2003.

PROJECT HIGHLIGHTS
Vitria Technology, Inc.

- Product Demonstration: BusinessWare 4.2 "Integration Platform and Vertical Solutions Best Optimized to Enable Business Process Fusion." Gartner Application Integration and Web Services Summit, Baltimore, MD, 2003.
- Product Demonstration: "Software and Service Solutions for Healthcare Business Process Integration including Vitria: SmartClaims and Vitria: SmartResponse." Health Insurance Association of America's (HIAA) Forum & Exhibit, Las Vegas, NE, 2003.
- Skeen, D. "Business Process Fusion." Gartner Forum, Chicago, IL, 2003.
- Skeen, D. "'Optimizing Business Processes Across Your Organization." Mexico City, Mexico, 2003.
- Product Demonstration: "Vitria Care Integrator™ and Vitria Claims Transaction Manager." Gartner Healthcare Business and IT Summit 2003, Boston, MA, 2003.
- Skeen, D. "Business Process Fusion." Enterprise Outlook 2003, Palo Alto, CA, 2003.
- Chang, JoMei, Gary Velasquez, and Graham Smith. "Vitria Collaborative Applications." Goldman Sachs Software and IT Services Conference, Laguna Niguel, CA, 2002.